

APPLICATION FORM FOR A NEW APPLICATION				Docket No. H09-033
Engineering Control Room		Date Dec. 5, 1997		
Department Manager	Person in Charge	Division Applying for New Application		
Dec. 15, 1997 Mizoguchi approved	Dec. 12, 1997 Maki approved	Dec. 10, 1997 Muraki	Dec. 8, 1997 Muraki	Dec. 5, 1997 Suzuki
Title of Invention (provisional)		Machining Navigation		
Division to which the Inventor Belongs		Machining Technology Research Center (Extension: 3436)		
Inventor Name	Kenji SUZUKI			
Model Number	FH580N, FJV25N (Mounting NM64)			
Expected Disclosure Date in Catalogue or as a Product	February 1, 1998			
1. Objective				
To reduce machining time.				
2. Prior Art Having the Same Objective or Using a Similar Method Attachment				
Mazatrol Program (NC Control) allows cutting conditions such as cutting speed and feed rate to be automatically calculated.				
3. Problems in Prior Art to be Solved				
Appropriate cutting conditions for given machines and tools in high speed cutting are not provided.				
4. Embodiment of Invention: Configuration or Method of the Present Invention [Attachment]⇒Display Algorithm				
<p>1) During operation, automatically determined values of cutting conditions are displayed in accordance with the specification of the apparatus (in a graph showing the relationship between the spindle rotating speed and the spindle output). At the same time, specific figures that indicate, for example, how many meters per minute the cutting speed can be increased, are displayed.</p> <p>2) High-speed machining examples (of MAZAK apparatus's performance) are displayed. Tools (type &amp; manufacturer) and cutting conditions (cutting speed &amp; feed rate) are displayed.</p>				
5. Effect of Invention				
By displaying high-speed and highly efficient cutting conditions, the invention permits an operator to attempt and achieve reduction in machining time of a variety of apparatuses including an apparatus for normal cutting and an apparatus for high-speed cutting, while making use of the characteristics of the Mazotrol Program (NC control).				
6. Special Note				

Assignment		Date: December 5, 1997
<p><b>Assignee</b></p> <p>[Address] 1, Aza-Norifune, Ohaza-Oguchi, Ohguchi-cho, Niwa-gun, Aichi-ken  [Name] YAMAZAKI MAZAK KABUSHIKI KAISHA  [Representative] Teruyuki YAMAZAKI (President)</p> <p>※/We hereby declare that I/we assign the entire right, title, and interest in the invention described in Application Form for a New Application..</p>		
<p><b>Assignor</b></p> <p>[Address] 366-1, Mizuse, Yono, Ohguchi-cho,  89, Minamiyama, Hiroji-cho,  Niwa-gun, Aichi-ken  [Name] Kenji SUZUKI (Seal)</p> <p>[Address] 72-2, Nakayashiki, Takao, Fuso-cho  Niwa-gun, Aichi-ken  [Name] Makoto TANAHASHI (Seal)</p> <p>(When there are additional inventors, please attach another sheet.)</p>		
<p>※Prior Art (including the related applications/patents owned by YAMAZAKI MAZAK)</p>		
<p>※Comments by Engineering Control Room</p> <p>Having reviewed this invention, we decided that we would ( <u>file</u> / not file ) a new application.</p> <p>On October 23, we discussed this invention with Mr. Aida, who is the patent attorney in charge.</p>		
Representative	AIDA PATENT ATTORNEY'S OFFICE	Category A
Docket No.	H09-033	

October 8, 1997

YAMAZAKI MAZAK KABUSHIKI KAISHA

Machining Technology Research Center

Indication of Navigation Information: Consideration of Algorithm

<Drilling Machining> Tool diameter  $\geq \phi 3$ 

Spindle Load $\leq$ SF?	Cutting Speed $\leq$ WJ?	Spindle Rotating Speed $\leq$ CH?	Processing
No	No	-	-
No	Yes	-	
Yes	No	-	Navigation Information Number 2 is displayed. (Change cutting tool material.)
Yes	Yes	-	Navigation Information Number 1 is displayed. (Increase cutting speed.)

## &lt;End Mil (Roughing) Machining&gt;

Spindle Load $\leq$ SF?	Cutting Speed $\leq$ WJ?	Spindle Rotating Speed $\leq$ CH?	Processing
No	No	No	-
No	No	Yes	Navigation Information Number 4 is displayed. (Change cutting tool material.)
No	Yes	No	
No	Yes	Yes	Navigation Information Number 3 is displayed. (Increase cutting speed.)
Yes	No	No	Navigation Information Number 4 is displayed. (Change cutting tool material.)
Yes	No	Yes	Navigation Information Number 4 is displayed. (Change cutting tool material.)
Yes	Yes	No	Navigation Information Number 3 is displayed. (Increase cutting speed.)
Yes	Yes	Yes	Navigation Information Number 3 is displayed. (Increase cutting speed.)

## &lt;Face Mil (Roughing) Machining&gt;

Spindle Load $\leq$ SF?	Cutting Speed $\leq$ WJ?	Spindle Rotating Speed $\leq$ CH?	Processing
No	No	No	-
No	No	Yes	Navigation Information Number 6 is displayed. (Change cutting tool material.)
No	Yes	No	
No	Yes	Yes	Navigation Information Number 5 is displayed. (Increase cutting speed.)
Yes	No	No	
Yes	No	Yes	Navigation Information Number 7 is displayed. (Change tool diameter.)
Yes	Yes	No	Navigation Information Number 5 is displayed. (Increase cutting speed.)
Yes	Yes	Yes	Navigation Information Number 5 is displayed. (Increase cutting speed.)

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Navigation Information Number	Message
1	·Increasing cutting speed to limit value is possible
2	·Change cutting tool material and increase cutting speed Change HSS tool (small diameter) to carbide tool Change HSS tool (large diameter) to throw away tool Change carbide tool to coolant through tool (for spindle through machines) Change carbide tool to carbide coating tool (for non-spindle through machines)
3	·Increase cutting speed to limit value (fix cutting speed if cutting speed is equal to or higher than maximum spindle rotating speed)
4	·Change cutting tool material and increase cutting speed Change HSS tool (small diameter) to carbide tool Change HSS tool (large diameter) to throw away tool
5	·Increasing cutting speed to limit value is possible (fix cutting speed if cutting speed is equal to or higher than maximum spindle rotating speed)
6	·Change cutting tool material and increase cutting speed Change carbide tool to carbide coating tool (except when the workpiece material is AL)
7	·Decrease tool diameter and increase rotating speed
8	·Increasing cutting speed to limit value is possible (fix cutting speed if cutting speed is equal to or higher than maximum spindle rotating speed)
9	·Change to tool with a larger teeth number and increase feed rate ·Change cutting tool material and increase cutting speed ·Change HSS tool to carbide tool Change carbide tool to carbide coating tool (except when the workpiece material is AL)
10	·Change to tool with a larger teeth number and increase feed rate ·Change cutting tool material and increase cutting speed (except when workpiece material is AL) Change carbide tool to carbide coating tool or cermet tool Change carbide coating tool to cermet tool
*) The above may change depending on conditions of workpiece clamping and cutting tools. Life of tools may be shortened.	

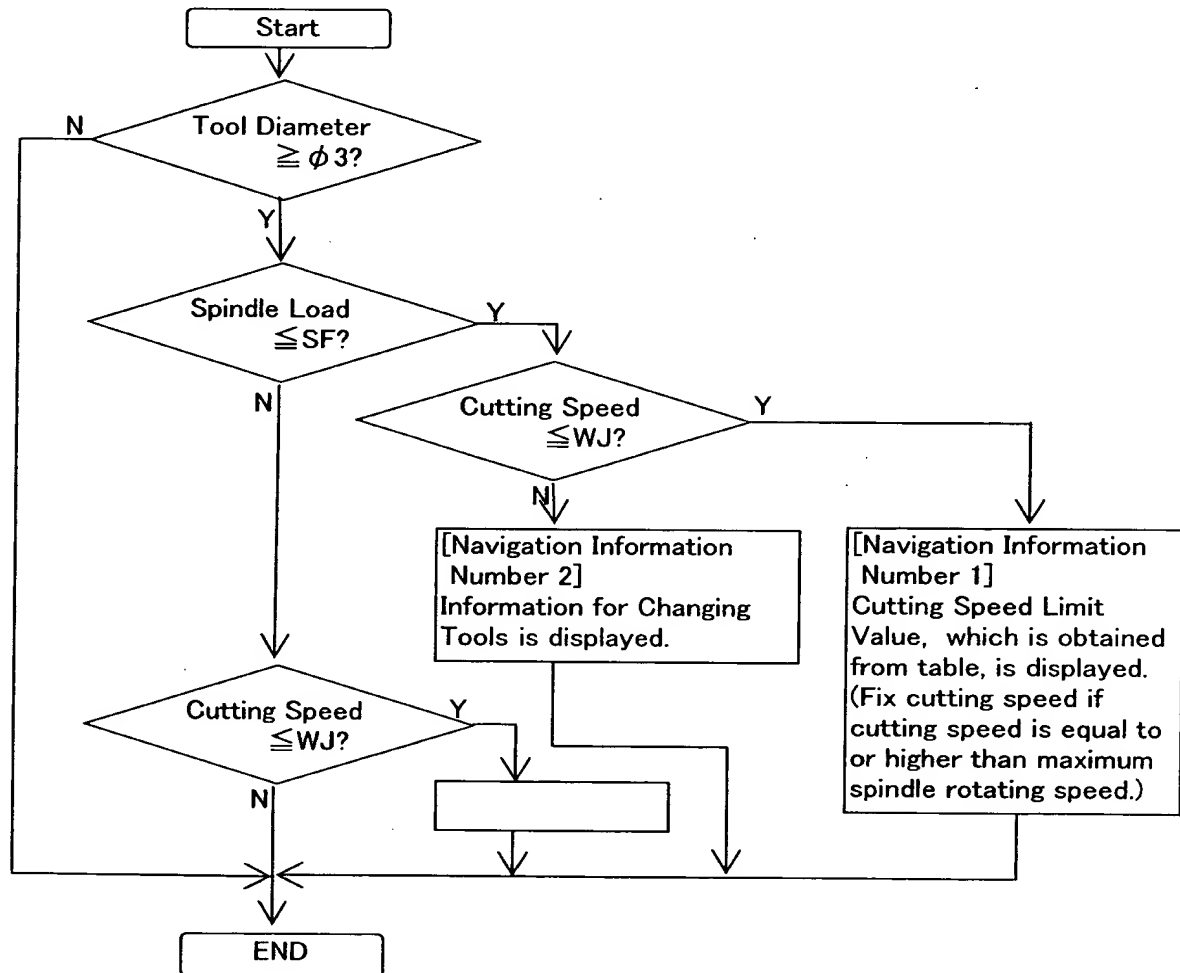
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## Machining Navigation: Navigating Function Flow Chart

## Drilling Machining



1) Spindle Load Limit Value Parameter...80% (default: 80%)

2) Drilling Machining Cutting Speed Limit Value Table

Cutting speed limit value is calculated in accordance with the rules for automatically determining cutting conditions.

	Basic Cutting Speed Limit Value
FC	29
FCD	26
S45C	29
SCM	23
SUS	14
AL	75
CU	75
...	

Workpiece  
Material

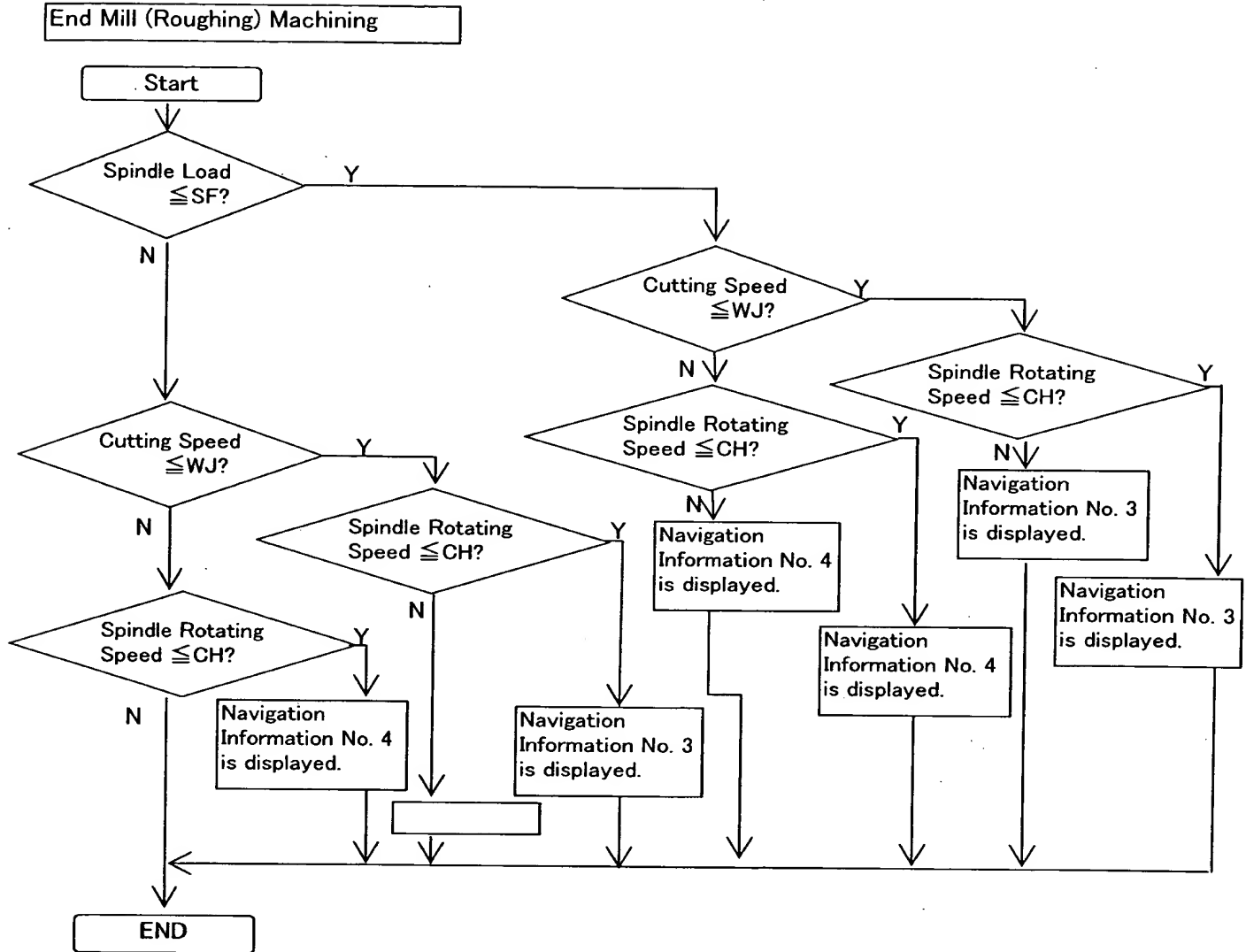
m/min

	Compensation Coefficient
HSS	100
Carbide	220
HSS Coating	145
Coolant Through	460
Throw Away	560
Brazed	240

Tool Material

%

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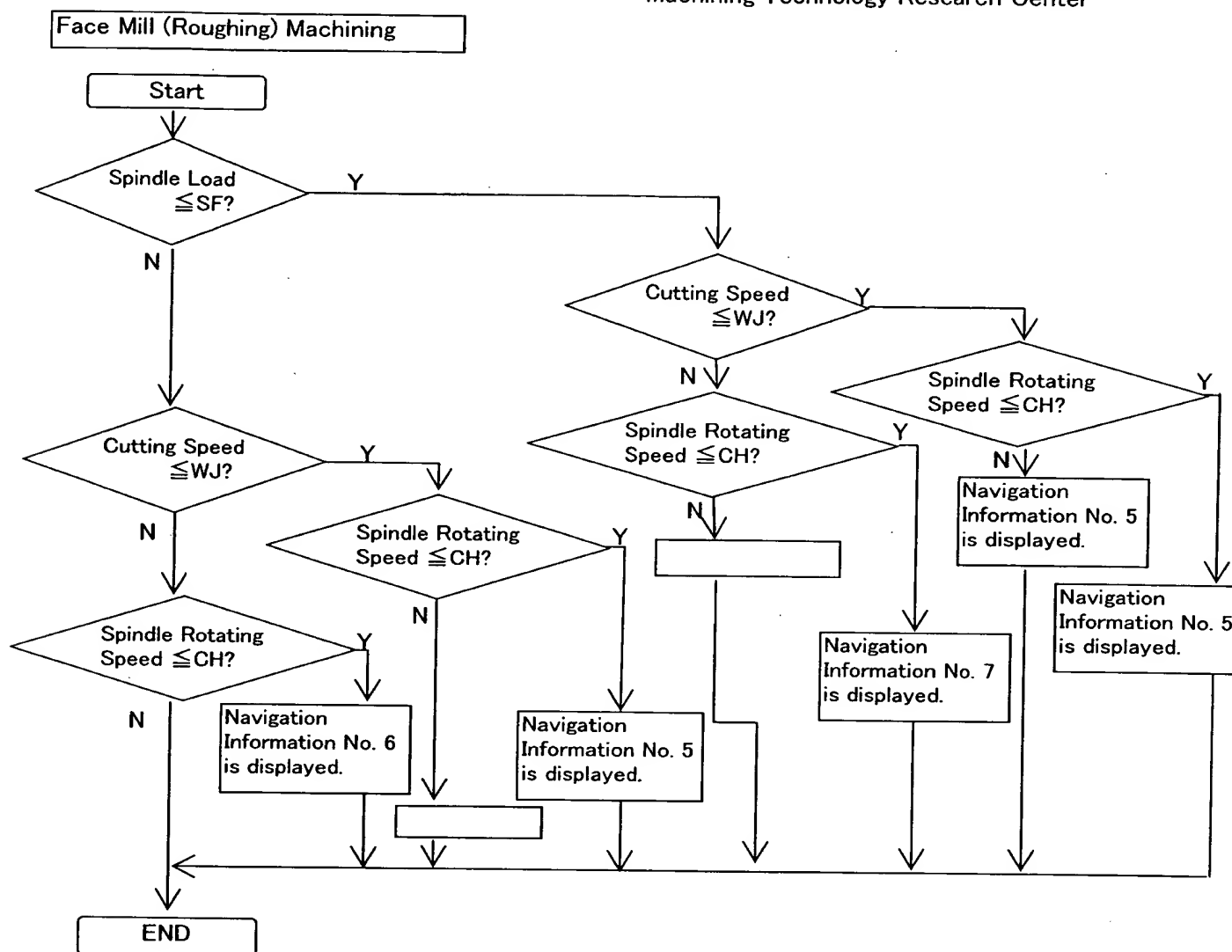
## 3) End Mill Machining Cutting Speed Limit Value Table

Cutting speed limit value is calculated in accordance with the rules for automatically determining cutting conditions.

	Basic Cutting Speed Limit Value
FC	124
FCD	104
S45C	98
SCM	92
SUS	86
AL	690
CU	230
...	

	Compensation Coefficient
HSS	27
Carbide	100
HSS Coating	32
Carbide Coating	112
Roughing	38
Throw Away	150
...	

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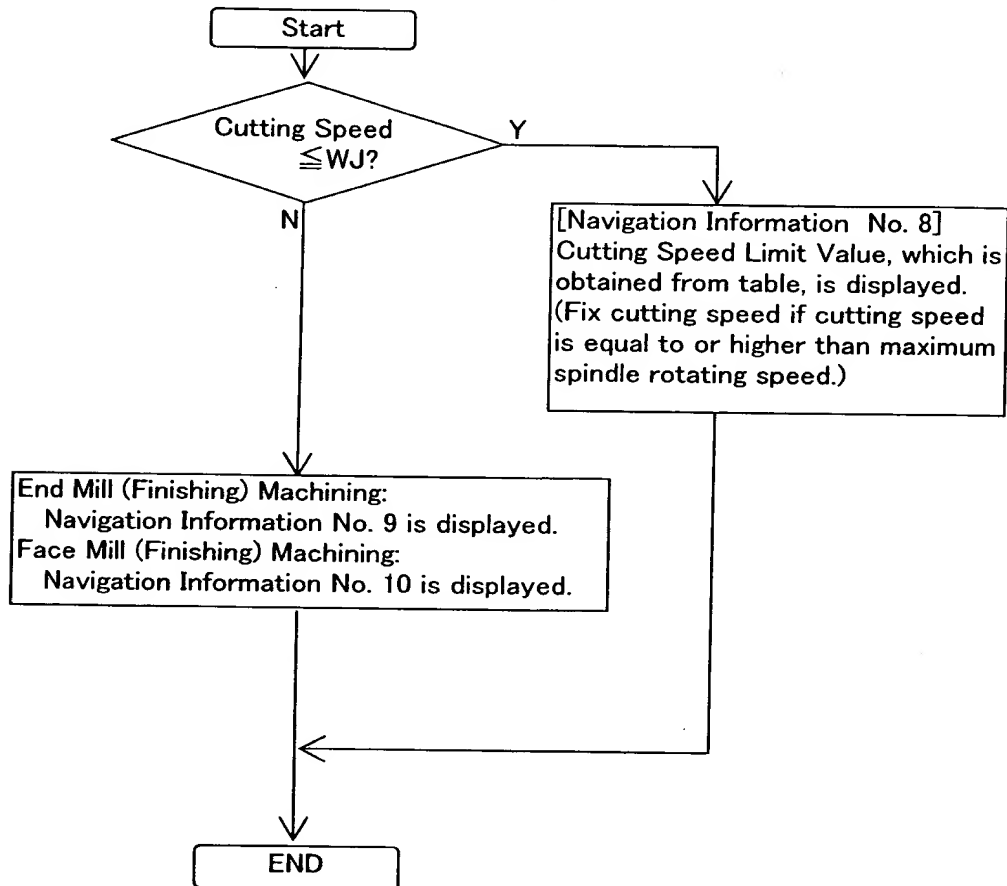


Cutting speed limit value is calculated in accordance with the rules for automatically determining cutting conditions.

	Basic Cutting Speed Limit Value
FC	138
FCD	124
S45C	184
SCM	138
SUS	184
AL	990
CU	300
...	

	Compensation Coefficient
Carbide	100
Cermet	120
Carbide Coating	115
...	

October 8, 1997

YAMAZAKI MAZAK KABUSHIKI KAISHA  
Machining Technology Research CenterEnd Mill (Finishing) Machining, Face Mill (Finishing) Machining and ~~Drilling Machining~~

## 4) Drilling Machining Cutting Speed Limit Value Table

Cutting speed limit value is calculated in accordance with the rules for automatically determining cutting conditions.

	Basic Cutting Speed Limit Value
FC	69
FCD	80
S45C	109
SCM	92
SUS	288
AL	143
CU	
...	

	Compensation Coefficient
HSS	55
Carbide	100
Cermet	100
Balanced Cut	120
...	